

JC05 Rec'd PCT TO 28 FEB 2002

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TRADEMARK OFFICE
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U.S. DEPARTMENT OF COMMERCE PATENT AND

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. § 371**

449122024600

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

10/069792
Not yet assigned

INTERNATIONAL APPLICATION NO

INTERNATIONAL FILING DATE

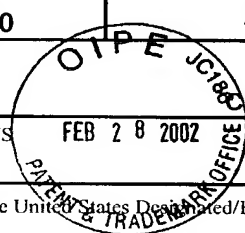
PRIORITY DATE CLAIMED

PCT/DE00/02870

August 23, 2000

August 31, 1999

TITLE OF INVENTION



COMMUNICATIONS SYSTEM

APPLICANT(S) FOR DO/EO/US

FEB 28 2002

Axel BUERCK et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ An English language translation of the International Application under PCT Article 19 (35 U.S.C. 371(c)(2))
 - a. ☒ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made, however, the time limit for making such amendments has NOT expired
 - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

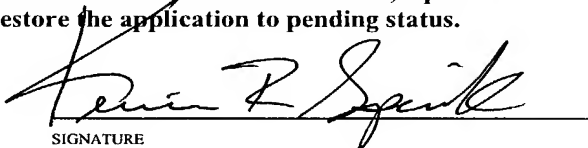
Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included
13. ☐ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification
16. ☐ A change of power of attorney and/or address letter
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter 2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items: 1) Application Data Sheet; 2) Int'l Search Report; 3) IPER; 4) Return receipt postcard.

CERTIFICATE OF HAND DELIVERY

I hereby certify that this correspondence is being hand filed with the United States Patent and Trademark Office in Washington, D.C. on February 28, 2002.

Melissa Garton

U.S. APPLICATION NO (if known, see 37 CFR 1.5) Not yet assigned		INTERNATIONAL APPLICATION NO PCT/DE00/02870		ATTORNEY DOCKET NO 449122024600																																
21. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO.....\$1,040.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO.....\$890.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$740.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provision of PCT Article 33(1)-(4)\$710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)\$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT = \$890.00 Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)). \$0 <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:20%;">CLAIMS</th> <th style="width:20%;">NUMBER FILED</th> <th style="width:20%;">NUMBER EXTRA</th> <th style="width:20%;">RATE</th> <th style="width:20%;"></th> </tr> <tr> <td>Total claims</td> <td>- 20 =</td> <td></td> <td>x \$18.00</td> <td>\$0</td> </tr> <tr> <td>Independent claims</td> <td>- 3 =</td> <td></td> <td>x \$84.00</td> <td>\$0</td> </tr> <tr> <td colspan="3">MULTIPLE DEPENDENT CLAIM(S) (if applicable)</td> <td>+ \$280.00</td> <td>\$0</td> </tr> <tr> <td colspan="4">TOTAL OF ABOVE CALCULATIONS =</td> <td>\$890.00</td> </tr> </table> <input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. \$0 SUBTOTAL = \$890.00 Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)). + \$0 TOTAL NATIONAL FEE = \$890.00 Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property + \$0 TOTAL FEES ENCLOSED = \$890.00 <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:80%;"></td> <td style="width:10%; text-align: center;">Amount to be refunded:</td> <td style="width:10%; text-align: center;">\$</td> </tr> <tr> <td></td> <td style="text-align: center;">charged:</td> <td style="text-align: center;">\$</td> </tr> </table>				CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		Total claims	- 20 =		x \$18.00	\$0	Independent claims	- 3 =		x \$84.00	\$0	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$280.00	\$0	TOTAL OF ABOVE CALCULATIONS =				\$890.00		Amount to be refunded:	\$		charged:	\$	CALCULATIONS PTO USE ONLY	
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a. <input checked="" type="checkbox"/> Please charge my Deposit Account No. 03-1952 (referencing Docket No. 449122024600) in the amount of \$890.00 to cover the above fees. A duplicate copy of this sheet is enclosed. b. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees that may be required, or credit any overpayment to Deposit Account No. 03-1952 (referencing Docket No. 449122024600). NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status. SEND ALL CORRESPONDENCE TO: Kevin R. Spivak Morrison & Foerster LLP 2000 Pennsylvania Avenue, N.W. Washington, D.C. 20006-1888 <div style="text-align: right; margin-top: 20px;">  SIGNATURE Kevin R. Spivak Registration No. 43,148 February 28, 2002 </div>																																				

13 Rec'd PCT/PTO 10 JUN 2002
10/069792

CERTIFICATE OF HAND DELIVERY

I hereby certify that this correspondence is being hand filed with the United States Patent and Trademark Office in Washington, D.C. on June 10, 2002.

M. Ayim

Mildred I. Ayim

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of:

Axel BUERCK et al.

Serial No.: 10/069,792

Filing Date: February 28, 2002

For: COMMUNICATIONS SYSTEM

Examiner: Not yet assigned

Group Art Unit: Not yet assigned

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination on the merits, please amend this application as follows:

In the Claims:

1. A method for setting up and/or clearing a communications link, comprising:
setting up and/or clearing a communications link for transporting communication data which is carried out by at least one functional unit in a communications network; and
controlling the connection function which is carried out by a second functional unit in the communications network, wherein
the first and the second functional units are physically separated from one another.
2. The method as claimed in claim 1, further comprising:
signaling to control the setting up and/or clearing of a communications link,
wherein
the connection is set up and/or cleared via a transport network; and
signaling is carried out via a control network.
3. The method as claimed in claim 2, in which the signaling is controlled by a central device.

4. The method as claimed in claim 1, further comprising setting up the communications link in the transport network via at least one decentralized device.
5. The method as claimed in claim 3, wherein the central device controls a decentralized switching device.
6. The method as claimed in claim 1, further comprising setting up and/or clearing a communications link to a communications terminal, and setting up the connection via the transport network by producing at least one time slot control information item in the central device, which information item is used for setting up connections in the transport network.
7. The method as claimed in claim 6, linking the time slot control information is to transport-network-specific information and transmitting to a decentralized device.
8. The method as claimed in claim 1, wherein an asynchronous transmission method is used for transmission via the communications link.
9. The method as claimed in claim 2, further comprising providing at least one connection-related service feature and/or a service feature or application, related to the central device by the central device.
10. An arrangement for setting up and/or clearing a communications link, comprising:
 - a transport network to provide a communications link;
 - a control network to control the setting up and/or clearing of the communications link; and
 - a device to control the setting-up and/or clearing of connections in the transport network by a control network, the device arranged physically separately from the transport network.
11. The arrangement as claimed in claim 10, in which the transport network has at least one decentralized device to connect with a communications terminal, and has a switching device in the region of the decentralized device to provide a communications link in the transport network.
12. The arrangement as claimed in claim 10, in which the control network has a central device for control.

13. The arrangement as claimed in claim 11, which has a central device to provide at least one connection-related service feature and/or a service feature or application relating to a central device, the device being operatively connected to the central device.

14. The arrangement as claimed in claim 10, which is in the form of a private branch exchange and has at least two decentralized devices for connection of communications terminals.

16. The arrangement as claimed in claim 10, wherein in the region of the decentralized device, there is a control device to provide a communications link in the region of this decentralized device, if the central control device is not available.

17. (New) The method as claimed in claim 4, in which the central device controls a decentralized switching device.

18. (New) The arrangement as claimed in claim 11, which is in the form of a private branch exchange and has at least two decentralized devices for connection of communications terminals.

19. (New) An arrangement for setting up and/or clearing a communications link, comprising:

- a transport network to provide a communications link;
- a control network to control the setting up and/or clearing of the communications link; and
- a device to control the setting-up and/or clearing of connections in the transport network by a control network, the device arranged physically separately from the transport network.

20.(New) An arrangement for setting up and/or clearing a communications link, comprising:

- a transport network to provide a communications link;
- a control network to control the setting up and/or clearing of the communications link;
- a device to control the setting-up and/or clearing of connections in the transport network by a control network, the device arranged physically separately from the transport network, wherein

the transport network has at least one decentralized device to connect with a communications terminal, and has a switching device in the region of the decentralized device to provide a communications link in the transport network,

the control network has a central device for control; and

a central device to provide at least one connection-related service feature and/or a service feature or application relating to a central device, the device being operatively connected to the central device.

In the Abstract:

Please replace the Abstract with the substitute Abstract attached hereto.

REMARKS

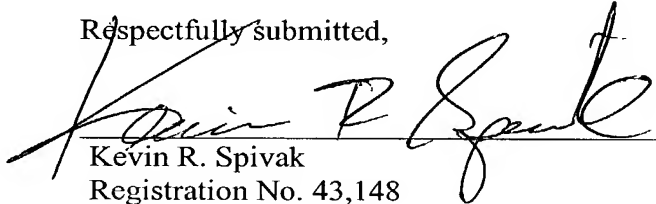
Amendments to the specification have been made and are submitted herewith in the attached Substitute Specification. A clean copy of the specification and a marked-up version showing the changes made are attached herewith. The claims and abstract have been amended in the attached Preliminary Amendment. All amendments have been made to place the application in proper U.S. format and to conform with proper grammatical and idiomatic English. None of the amendments herein are made for reasons related to patentability. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with markings to show changes made**".

In the event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing docket no. 449122024600.

Respectfully submitted,

Dated: June 10, 2002


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VERSION WITH MARKINGS TO SHOW CHANGES MADE

For the convenience of the Examiner, the changes made are shown below with deleted text in strikethrough and added text in underline.

In the Claims:

1. A method for setting up and/or clearing a communications link, **comprising:**
~~having the following features:~~
 - a) ~~a connection function (CS1, CS2, 700) for~~
 setting up and/or clearing a communications link for transporting communication data **which** is carried out by at least one functional unit in a communications network; **and**
 - b) ~~a control function for~~
 controlling the connection function **which** is carried out by a second functional unit (~~ZE2, 310, 410~~) in the communications network; ~~and, wherein~~
 - e) the first and the second functional units are physically separated from one another.
2. The method as claimed in claim 1, ~~having the following features:~~ **further comprising:**
 - a) ~~signaling is carried out in order~~ **signaling** to control the setting up and/or clearing of a communications link, **wherein;**
 - b)
 - e) the connection is set up and/or cleared via a transport network(700); **and** e) signaling is carried out via a control network(310, 410).
3. The method as claimed in claim 2, in which the signaling is controlled by a central device(~~ZE2~~).
4. The method as claimed in ~~one of the preceding claims, in which~~ **claim 1, further comprising setting up** the communications link in the transport network ~~is set up~~ via at least one decentralized device(CS1, CS2).
5. The method as claimed in ~~claims 3 and 4, in which~~ **claim 3, wherein** the central device (~~ZE2~~) controls a decentralized switching device(CS1, CS2).
6. The method as claimed in ~~one of the preceding claims, in which~~ **claim 1, further comprising setting up and/or clearing** a communications link (~~300, 400~~) ~~is set up and/or cleared to a communications terminal(KE1), and in which~~ **setting up** the connection via

the transport network (700) is set up by producing at least one time slot control information item in the central device (ZE2), which information item is used for setting up connections in the transport network (700).

7. The method as claimed in claim 6, ~~in which~~ **linking** the time slot control information is ~~linked~~ to transport-network-specific information and ~~is transmitted~~ **transmitting** to a decentralized device (CS1, CS2).

8. The method as claimed in ~~one of the preceding claims~~, ~~in which~~ **claim 1, wherein** an asynchronous transmission method is used for transmission via the communications link (700).

9. The method as claimed in ~~one of claims 2 to 7~~, ~~in which~~ **claim 2, further comprising providing** at least one connection-related service feature and/or a service feature or application, related to the central device is ~~provided~~ by the central device (ZE).

10. An arrangement for setting up and/or clearing a communications link, **comprising:**
~~a) which has a transport network (700) for providing~~ **to provide** a communications link; ~~(300, 400);~~
b) which has
a control network (310, 410) ~~for controlling~~ **to control** the setting up and/or clearing of the communications link (700, 300, 400); ~~;~~ **and**
c) ~~and which has means for controlling~~ **a device to control** the setting-up and/or clearing of connections in the transport network (300, 400, 700) ~~by means of~~ **by** a control network (310, 410), ~~with these means being,~~ **the device** arranged physically separately from the transport network.

11. The arrangement as claimed in claim 9 **10**, in which the transport network has at least one decentralized device ~~((SLMO1, SLMO2) for connection of a communications terminal (KE1, KE2)~~ **to connect with a communications terminal**, and has a switching device (CS1, CS2) in the region of the decentralized device ~~in order~~ to provide a communications link in the transport network.

12. The arrangement as claimed in claim 9 **10**, in which the control network (310, 410) has a central device (ZE2) for control.

13. The arrangement as claimed in claim 11, which has ~~a central means for providing~~ **device to provide** at least one connection-related service feature and/or a service feature

or application relating to a central device, ~~with these means~~ the device being operatively connected to the central device(~~ZE2~~).

14. The arrangement as claimed in claim 10 ~~or 11~~, which is in the form of a private branch exchange and has at least two decentralized devices (~~DZ1, DZ2~~) for connection of communications terminals(~~KE1, KE2~~).

~~15~~ 16. The arrangement as claimed in claim 10, wherein ~~12 and claim 13~~.

~~16. The arrangement as claimed in one of claims 9 to 14, which, in the region of the decentralized device(DZ1, DZ2), has, there is~~ a control device (CS1, CS2) for providing to provide a communications link in the region of this decentralized device, if the central control device (~~ZE2~~) ~~is not available~~. is not available.

~~Abstract~~ 17. (New) The method as claimed in claim 4, in which the central device controls a decentralized switching device.

~~Communications system~~ 18. (New) The arrangement as claimed in claim 11, which is in the form of a private branch exchange and has at least two decentralized devices for connection of communications terminals.

19. (New) An arrangement for setting up and/or clearing a communications link, comprising:

a transport network to provide a communications link;
a control network to control the setting up and/or clearing of the communications link; and
a device to control the setting-up and/or clearing of connections in the transport network by a control network, the device arranged physically separately from the transport network.

20.(New) An arrangement for setting up and/or clearing a communications link, comprising:

a transport network to provide a communications link;
a control network to control the setting up and/or clearing of the communications link;
a device to control the setting-up and/or clearing of connections in the transport network by a control network, the device arranged physically separately from the transport network, wherein

the transport network has at least one decentralized device to connect with a communications terminal, and has a switching device in the region of the decentralized device to provide a communications link in the transport network,
the control network has a central device for control; and
a central device to provide at least one connection-related service feature and/or a service feature or application relating to a central device, the device being operatively connected to the central device.

Communications system and method

Abstract

A method and an arrangement are specified for setting up and clearing communications links via a private branch exchange. The transport network for transporting the communication data is preferably in the form of an ATM network or IP network, and is controlled by a separate control network, separated from it. The advantage is that the two networks are independent of one another, and that broadband communications requirements can be satisfied easily by a modular expansion capability. The central control configuration allows already existing central databases relating to subscribers to be used, and likewise allows connection-related service feature control systems still to be used.

Communications system and method

5 CLAIM FOR PRIORITY

This application claims priority to International Application No. PCT/DE00/02870 which was published in the German Language on March 8, 2001.

10 TECHNICAL FIELD OF INVENTION

The invention relates to a method and system for setting up and clearing communications links, and in particular, to a private branch exchange and terminals connected thereto.

15 BACKGROUND OF THE INVENTION

The increase in the amount of traffic resulting from the rising number of communications subscribers, as well as more stringent requirements for the amount of data to be transmitted, means that switching devices, such as private branch exchanges, are subject to ever more stringent requirements. For example, the amount of data to be transmitted per communications link, and the number of communications terminals which can be connected to one another. Present-day devices are based, for example, on the TDM method (Time Division Multiplexing) in which communication data relating to different connections is transmitted in respectively defined time slots. Connection between different communications partners is produced by a switching matrix, which allocates incoming time slots on an incoming connection to outgoing time slots on an outgoing connection, on the basis of control information. Switching matrices such as these are generally of a fixed size and can produce only a defined number of connections, which often makes it harder to adapt switching systems to meet the requirements. Devices such as these have a further

problem in that the time slots can hold a limited amount of data. For example, a switching matrix can produce 4096 connections, while a maximum of 64 KBits of data can be transmitted within one time slot. An increasing number of subscribers can thus only ever be coped with in groups of 4096 connections. However, utilization of these different extension levels demands additional development effort to match the switching device to the greater number of subscribers. It is likewise impossible without problems to increase the amount of communication on each connection in a flexible manner, and this can best be done by setting up two or more communications links, e.g. in the form of a 64 kbit fit. In practice, this type of bandwidth duplication has, however, not been implemented for ISDN (Integrated Services Digital Network) transmission, and scarcely any terminals are available for this purpose.

SUMMARY OF THE INVENTION

In one embodiment of the invention, there is a method and system for providing a communications link, which allow a high level of flexibility with regard to matching to the number of communications links to be provided, matching to the amount of communication per connection, and to their physical extent.

In one aspect, control and connection functions are carried out in an advantageous manner by functional units which are physically separated from one another, since this allows distributed switching systems with the advantageous characteristics of central systems to be set up without any major development effort.

According to the invention, the control function is advantageously provided in a control network, and the connection function is offered via a transport network, advantageously with the assistance of a connection device which may reside on a transport

network of any desired type that is available and is suitable depending on the type of application.

Hence, an increased amount of communication can be
5 dealt with by an appropriately designed transport network with an adequate transmission capacity, while the control, for example of a control network, need not be expanded, and can remain in its already existing form. Furthermore, the method ensures that
10 decentralized communications arrangements which are distributed over a physically large area can be operated in which, the control information to a central control device is handled, while the communications links are provided via a separate transport network of
15 suitable topology.

According to another aspect of the invention, when using a central control device, existing databases and control methods for a central switching device can
20 still advantageously be used in order to control decentralized switching devices in the transport network in order to provide a communications link. This ensures smooth migration of existing solutions to the described new solution, while retaining the advantages
25 of central data administration, as well as defect identification and rectification, with greater flexibility.

In another aspect, connections are set up via
30 decentralized devices in the transport network. This advantageously allows transport connections to be provided within a decentralized device, whose data streams therefore do not place any load on the central controller. A high level of redundancy is achieved and
35 switching devices can in each case be used for the transport network, for example at the moment, ATM, Ethernet or IP switching devices.

In another embodiment of the invention, one central device controls the decentralized switching devices in a particularly advantageous manner. This allows a number of decentralized devices to be
5 connected to one another which, together, behave like a single switching device. In this way, connection-related service features, which are implemented centrally, can be provided for communications links via the transport network without needing any additional
10 development work with regard to the transport network. There is likewise no need for adaptations to the existing service features at the control end in order to make them available throughout the network. It is also advantageous to use methods such as this in
15 distributed switching devices throughout the network, which would otherwise be available in a single local switching device, and not in a number of switching devices. Applications and interfaces for applications which until now have been able to access only single
20 systems can thus advantageously be used for the decentralized switching devices as well.

In still another embodiment, terminals which can be accessed by a time slot multiplexing connection can
25 advantageously be connected via the transport network, with new suitable connection information being generated in the controller from conventional time-slot-related connection information, in order to control the provision of a communications link via the
30 transport network. This allows already existing methods to be used to control TDM switching matrices, in order to set up connections based on this variant of the method.

35 However, the method is also suitable, without any restrictions, for other dynamically set-up connections, such as ATM connections or IP connections. For the controller, these connections appear to be similar to

conventional TDM connections, and are also processed in the same way, specifically with conventional time-slot-related connection information also being generated for this purpose, which is then in turn converted to new
5 connection information, matched to the transport network. This also allows terminals which are not time-slot-related (not TDM-based) to be connected, such as IP or ATM terminals, e.g. IP telephones, computers and ATM terminals.

10

Already existing methods for controlling TDM connections can be used in this way in order to set up other connections.

15

This advantageously reduces the technical implementation effort and makes it easier for existing methods to migrate to new methods, since all that is necessary is for the control information to be matched to the requirements of the transport network.

20

In yet another embodiment, transport network connections are produced in a particularly advantageous manner by using an asynchronous transfer mode, since ATM networks are technically proven and offer a basis
25 for greater transport capacities and more flexible distribution of them. Furthermore ATM networks are particularly suitable for the time-critical transmission of high data rates via decentralized switching devices, since they can guarantee the quality
30 features (quality of service) required for voice and moving pictures.

In still another embodiment, service features are provided in a particularly advantageous manner via the
35 central control device, since this allows any desired transport network to be supplied to an existing service feature control network. Furthermore, this advantageously allows already existing methods to be

used to provide service features, and there is no need
for independent service feature control adaptation for
each transport network. In this way, the transport
network can be replaced without any major control
5 reactions.

In another embodiment of the invention, there is a
system including, for example, a communications link
which has a separate control network, in particular for
10 transmitting signaling information, and a separate
transport network, in which the transport network is
controlled by the control network via suitable means.
The separation of the control network and transport
network relates to the information routes through the
15 network, e.g. to the logical topology of the networks.
Physically, it is possible to use different networks or
the same network for transmission. In this way, a
minimal configuration is specified to solve the problem
of specifying a communications arrangement which can be
20 expanded in a flexible manner for any desired data
transmission rates. They can also advantageously be
adapted on a subscriber-specific basis.

In one aspect, the transport network
25 advantageously has a decentralized device for
connection of a communications terminal, and a
decentralized switching device, which is provided in
the area of the decentralized device, in order to
provide a communications device in the transport
30 network. This makes it possible to supply large areas
with communications links via a single private branch
exchange, with the capability to keep the wiring
complexity at a minimal level, since the control
network is routed to a control center, while the most
35 suitable topology, even in the context of already laid
or public networks, can be chosen for connecting the
decentralized switching devices through the transport
network.

In one aspect of the system, there is a central control device in the control network, since this makes it possible for the subscriber administration and connection control, as well as the data storage, maintenance and protection associated with them, problem identification and rectification, and supply of new software issue standards to be carried out centrally.

10

In another aspect of the system, the central control device is advantageously operatively connected to a device for providing service features. This may also be an integral component of the control device since this allows central provision of connection-related service features and other service features with minimal installation and implementation effort. In addition to service features, the device for providing service features can also provide further applications and/or an interface to applications which go beyond communications service features. External servers, for example for call center solutions, CTI (Computer Telephony Integration) can thus advantageously be connected in a centralized manner via standardized interfaces.

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According to one aspect, a private branch exchange can advantageously be set up, which combines at least two decentralized switching devices with a central control device since this provides a distributed private branch exchange in the form of a minimal configuration, which can be expanded in a modular manner as required.

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In another aspect of the configuration, there is a device for providing connection-related service features and other service features, since this means that there is no need for the respective decentralized

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provision and implementation of the service features in the transport network for this private branch exchange.

It is advantageous to have an emergency control
 5 device in the region of at least one decentralized device, which allows emergency operation between communications terminals which are connected to this decentralized device, if the central control device fails or the control network is interrupted. This
 10 achieves a very high level of availability with a single system, corresponding to the availability of networked systems.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Exemplary embodiments of the invention will be explained in more detail in the following text with reference to figures.

Figure 1 shows a conventional communications arrange-
 20 ment.

Figure 2 shows an example of a communications arrangement in the invention.

Figure 3 shows an example of a message sequence in a known switching system.

25 Figure 4 shows an example of a message sequence using time-slot-related connection information for the transport network.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

30 Figure 1 shows an example of a known private branch exchange 150 having two peripheral devices P1 and P2 to which a respective communications terminal KE1 or KE2 is connected, operating on a digital or analog basis. These peripheral devices P1 and P2 are
 35 accommodated in the same physical area as the central device ZE1. For example, they are located in the same room or in the same cabinet with it. The terminals fill defined time slots in PCM data streams (Pulse Code

Modulation) with communication data. The digital or analog communications terminals KE1 and KE2 are connected to respective subscriber line modules SLM01 and SLM02 which add to or take from the PCM data stream digital data which is intended for the respective terminals or originates from the respective terminals, via time slots which are defined by signaling. These PCM data streams are designated 100 and 200, respectively, in Figure 1. Furthermore, signaling connections are shown, which are represented by 110 and 210, respectively. It should be noted that this is only a logical representation, and is not a physical representation. However, in reality, the transport data and the signaling data are transmitted in the same connecting cable.

Furthermore, peripheral devices P1 and P2 as well as line trunk units LTUC1 and LTUC2 are shown here, which control the data traffic to the subscriber line modules of respective decentralized devices. The peripheral device P1 is supplied with signaling data via the line 110 and the peripheral device P2 is supplied with signaling data via the signaling line 210.

As illustrated, both the information to be transported and the signaling information are supplied to a central device ZE1 in this arrangement. In this case, messages 2 are collected and distributed by a message device DCL, and are interchanged between the central device ZE1 and peripheral devices P1, P2. The call processing CP controls the setting up and clearing of connections and uses, for example, equipment-specific interface functions DH which, for example, are in the form of program modules. Setting commands 1 for the switching matrix MTS are produced in this way. These setting commands essentially indicate which input of the switching matrix should be connected to which

output in order to produce a communications link. The control function and connection function are thus carried out by a single physically integrated functional unit in the communications network.

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Problems occur with configurations such as these, since the data to be transported should be supplied to the central device ZE1. This is true even when, for example, two communications terminals which are
10 connected to the same peripheral device P1 wish to communicate with one another. The wiring complexity that needs to be accepted in such devices increases with the distance between the terminals and the central device ZE1, so that this type of arrangement restricts
15 extension of the area covered by a private branch exchange, or makes the installation considerably more expensive when covering relatively large areas.

One alternative to extension of the area covered
20 by an individual device 150 would be to network a number of devices 150, although this would result in the advantages of a single system being lost. When networking a number of such devices 150, one exacerbating factor is that additional trunk assemblies
25 with additional connecting cables must be provided and installed in each case.

Problems likewise occur in such devices with the modular expansion capability, not only in the number of
30 connections but also in the amount of data which can be transmitted. By way of example, the switching matrix MTS may be provided as one entity. This means that, in the extreme, a new switching matrix with, for example, 4096 connections must be purchased and installed for
35 one additional connection. The transmission rate in such systems is limited, for example, by the capability to transmit a maximum of 64 KBits or some other administratively defined or technically restricted

amount of data, in each time slot, as is specified by the ISDN Standard. This type of configuration also makes it impossible to use different data rates on each individual communications link.

5

Figure 2 shows an example of a new arrangement for setting up communications links. By way of example, this arrangement shows the layout of a private branch exchange 250.

10

Components of the device which are the same as those in Figure 1 have the same reference symbols in Figure 2. Referring now to Figure 2, it is immediately evident that there is a separate transport network 700 and a separate control network 310/410 in this case. This layout of a switching system has the advantage that already existing networks, such as public or private networks, can be used for the transport network. In this case, the control network just needs to be routed to the central device ZE2.

20

The digital or analog communications terminals KE1 and KE2 are illustrated here as being connected to respective subscriber line modules SLMO1 and SLMO2. However, without any restrictions to the invention, it is also feasible to integrate terminals in an arrangement 250 such as this which can be connected directly to the transport network 700, bypassing, or without, SLMO. It is thus also possible to connect ATM terminals or else IP-based (Internet Protocol) terminals.

30

As illustrated, the decentralized devices DZ1 and DZ2 have respective decentralized switching devices CS1 and CS2 which may, for example, be in the form of ATM access devices. The illustration likewise shows that the switching matrix MTS0 is no longer used for connection tasks. Rather, the transport network carries out the connection tasks.

35

In this arrangement, at least one control information item is in each case provided for setting up the communications link for the respective decentralized switching devices CS1 and CS2 via the control lines 410 and 310 for this purpose, with this control information item being derived from time-slot-related control information. Furthermore, the figure shows that PCM data is converted on a respective data path 300 or 400 to cell data in accordance with the Standard of the transport network 700, such as ATM cell data. In this case, it should be noted that the use of an ATM network as the transport network serves as an exemplary embodiment in this case. Ethernets, other IP connections or even TDM connections can likewise be used for this purpose. The choice is dependent on the intended application and covers the entire range of available networks, both in the narrowband field and in the broadband field.

Since there are no communications links to the central device ZE2 in Figure 2, there is also no need in this embodiment to incur call charges for any connections of DZ1 and DZ2 to the central device ZE2 via public lines, for example tie lines, as would have been the case for communication from DZ1 to DZ2 until now with a remote peripheral device 150 from Figure 1. Call processing which is independent of the transport network but which is restricted essentially to basic call functionality is preferably carried out in the decentralized switching devices CS1 and CS2. Service features are provided by the central controller ZE2. Connections between the various decentralized devices are controlled by the central device ZE2 via signaling. The advantages of this arrangement are that it has both a narrowband and broadband capability. Furthermore, the transport network can be set up for both public networks and private networks, or else for a

combination of both. In addition, it is possible to allocate to the central device ZE2 decentralized devices at a physically unrestricted distance away, so that even very large devices can be provided by such a private branch exchange, which are in turn used to supply communications links for large areas. By retaining a central control device, it is possible to continue to use already existing software with minimal changes. If one were to distribute the control process, or else the switching matrix, then new methods would need to be developed for control and a mechanism would have to be provided to ensure consistency between distributed databases. A further advantage of such a device 250 over a networked system composed of devices 150 is that the distributed system is a single system, for which reason it is likewise possible to provide service features which are implemented within the system. There is thus no need to convert individual service features to provide them with the capability for operation on a network.

By way of example, Figure 3 shows a message sequence in a conventional communication system for setting up a connection between two peripheral devices to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. The time sequence of the messages, and control messages, is from top to bottom. First, the subscriber A goes off hook and generates the signaling information OFF HOOK. The desired communication partner is then dialed by entering dialing information, which is passed on from an equipment-specific interface module DH to the call processing CP for the subscriber A.

The dialing assessment WABE of the dialing information leads to a message SEIZURE being passed to the call processing CP for the subscriber B. An equipment-specific interface module DH, which has the

responsibility there, assigns to the connection an explicit time slot, for example, ZS1 on a defined PCM data path, for example PD1, and generates the control message TSL_ASSIGN to the subscriber line module SLM01.

5 This control message tells the subscriber line module SLM01 the explicit time slot ZS1 and the defined PCM data path PD1 which is intended to be used for that connection. The explicit time slot ZS1 in the PCM data path PD1 applies to the connection element between the

10 subscriber line module SLM01 and the MTS. A second explicit time slot ZS2 in a second explicitly defined PCM data path PD2 applies to the connection element between the MTS and the subscriber line module SLM02. The information ZS2 and PD2 is in turn signaled to the

15 subscriber line module SLM02 in a control message TSL_ASSIGN. Generally, TDM based private branch exchanges use a TDM switching matrix MTS for physical connection of individual subscribers. A setting command PATH_CONNECT1 is produced for this switching matrix and

20 results in the time slot ZS1 being connected from the PCM data path PD1 to the time slot ZS2 for the PCM data path PD2. The two connection elements are thus connected to form a continuous path between SLM01 and SLM02.

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In this case, in conjunction with the embodiment of the method, it is irrelevant whether the CP and DH are components of the control software, or whether they are in the form of individual modules or are

30 integrated.

By way of example, Figure 4 shows a message sequence between two decentralized devices, to which the terminal of a subscriber A, TLNA and the terminal

35 of a subscriber B, TLNB are connected. In this case, an ATM network is used, by way of example, as the transport network. The time sequence of the messages or signaling messages, is from top to bottom. A functional

unit STMA converts the time slot for the PCM data stream to a cell stream of ATM cells. In Figure 2 a device such as this is integrated in each of the decentralized switching devices CS1 and CS2, and for this reason is not shown separately.

The sequence differs from the sequence illustrated in Figure 3 from the point where the setting command PATH_CONNECT1 is produced for the TDM switching matrix. Instead of a setting command PATH_CONNECT1, a control message PATH_CONN2 is generated, which is sent to the decentralized switching devices. The decentralized switching devices then set up a connection on the transport network. When using an ATM transport network, by way of example, an ATMSVC is set up (ATM Switched Virtual Connection) by means of ATM signaling methods.

The control message PATH_CONN2 includes the time slot and data path information ZS and PD, which can be obtained, for example, directly from the setting message PATH_CONNECT1. Furthermore, the central control device specifies the transport-network-dependent address of that decentralized switching device for which the connection is intended to be set up. This means that the data which is provided as information via the transport network for the central control is restricted to the transport-network-dependent addresses of the respective decentralized switching devices. The central control device once again determines the necessary addresses from the time slot and data path information ZS and PD. Allocation tables in a central database DB control the mapping of the time slot/data path to the decentralized switching device.

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The control message PATH_CONN2 may also include other information, and the control message PATH_CONNECT may also be generated in a number of more specific

forms. If it is intended to set up connections with different bandwidths, the control message PATH_CONN2 may also include information about the desired bandwidth. Alternatively, the bandwidth information can
5 also be interchanged directly between the subscriber line module and the switching device.

When the decentralized switching devices have set up a connection in the transport network 700 after
10 receiving the message, PATH_CONN2, the user data is then transmitted via this transport network 700. The allocation of a user data stream on the data path 300/400 between the subscriber line module and the decentralized device DZ to a connection between DZ1 and
15 DZ2 is produced by mapping time slot details ZS and PD to form a connection identifier for the connection. This means that, despite the possibly complicated sequences for setting up a connection via the transport network from the central controller ZE2, preferably
20 only these addresses need to be passed on to the call processing for the transport network in order to set up a connection via this transport network. The transport-network-specific call processing handles the rest.

25 According to this message sequence, the PATH CONNECT command is thus replaced by transport-network-specific call processing. In order to allow TDM-based subscribers to be connected by decentralized switching devices independently of the transport network, it is
30 necessary to convert time slots to transport units. This is done in a conversion unit, such as STMA, of which each decentralized device has at least one, which is preferably looped into the path of the user data. An ATM-PCM gateway or an IP-PCM gateway can be provided
35 for this purpose.

The TDM-based subscriber line modules communicate with the conversion unit via, for example, connections

on a backplane motherboard in the respective decentralized device. A bus which connects the assemblies to one another can be provided for this purpose on the printed circuit board. The setting
5 commands for looping in the conversion unit are for this purpose preferably produced autonomously from the PATH__CONN2 message by the decentralized switching device.

10 However, the method is not restricted to dial connections that are set up dynamically, but can likewise control an ATMPVC (ATMPVC Permanent virtual connection). The information related to the address
must then be interchanged with information controlling
15 the use of fixed connections. Other forms of data transmission may also still be used, such as IP connections.

Description

5 Communications system and method

CLAIM FOR PRIORITY

This application claims priority to International
Application No. PCT/DE00/02870 which was published in
10 the German Language on March 8, 2001.

TECHNICAL FIELD OF INVENTION

The invention relates to a method and an
arrangement system for setting up and clearing
15 communications links, and in particular ~~for the~~
~~purposes of,~~ to a private branch exchange and the
terminals connected ~~to it.~~
thereto.

20 BACKGROUND OF THE INVENTION

The increase in the amount of traffic resulting
from the rising number of communications subscribers,
as well as more stringent requirements for the amount
of data to be transmitted, ~~mean~~ means that switching
25 devices, ~~in particular at~~ such as private branch
exchanges, are subject to ever more stringent
requirements ~~with regard to.~~ For example, the amount
of data to be transmitted per communications link, and
~~with regard to~~ the number of communications terminals
30 which can be connected to one another. Present-day
devices are based, for example, on the TDM method (Time
Division Multiplexing) in which communication data
relating to different connections is transmitted in
respectively defined time slots. Connection between
35 different communications partners is produced by ~~means~~
~~of~~ a switching matrix, which allocates incoming time
slots on a an incoming connection to outgoing time
slots on an outgoing connection, on the basis of
control information. Switching matrices such as these

are generally of a fixed size and can produce only a defined number of connections, which often makes it harder to adapt switching systems to meet the requirements. Devices such as these have a further
5 problem in that the time slots can hold a limited amount of data. For example, a switching matrix can produce 4096 connections, while a maximum of 64 KBits of data can be transmitted within one time slot. An increasing number of subscribers can thus only ever be
10 coped with in groups of 4096 connections. However, utilization of these different extension levels demands additional development effort to match the switching device to the greater number of subscribers. It is likewise impossible without problems to increase the
15 amount of communication on each connection in a flexible manner, and this can best be done by setting up two or more communications links, ~~that is to say~~ e.g. in the form of a 64 kbit fit. In practice, this type of bandwidth duplication has, however, not been
20 implemented for ISDN (Integrated Services Digital Network) transmission, and scarcely any terminals are available for this purpose.

SUMMARY OF THE INVENTION

25 In one embodiment of ~~The object on which the invention is based is to specify, there is~~ a method and an arrangement system for providing a communications link, which allow a high level of flexibility with regard to matching to the number of communications
30 links to be provided, matching to the amount of communication per connection, and to their physical extent.

For the method, ~~this object is achieved according to the features of patent claim 1, and for the arrangement it is achieved according to the features of patent claim 9. Developments of the invention can be found in the dependent claims.~~

Control In one aspect, control and connection functions are carried out in a particularly an advantageous manner by ~~means of~~ functional units which are physically
5 separated from one another, since this allows distributed switching systems with the advantageous characteristics of central systems to be set up without any major development effort.

10 According to the ~~described method~~ invention, the control function is advantageously ~~for this purpose~~ provided in a control network, and the connection function is offered via a transport network, advantageously with the assistance of a connection
15 device which may reside on a transport network of any desired type that is available and is suitable depending on the type of application.

~~This means that~~ Hence, an increased amount of
20 communication can be dealt with by an appropriately designed transport network with an adequate transmission capacity, while the control, for example of a control network, need not be expanded, and can remain in its already existing form. Furthermore, the
25 method ensures that decentralized communications arrangements which are distributed over a physically large area can be operated in which, ~~in a particularly advantageous manner, only~~ the control information to a central control device ~~need be~~ is handled, while the
30 communications links are provided via a separate transport network of suitable topology.

According to ~~one development~~ another aspect of the
~~described method~~ invention, when using a central
35 control device, existing databases and control methods for a central switching device can still advantageously be used in order to control decentralized switching devices in the transport network in order to provide a

communications link. This ensures smooth migration of existing solutions to the described new solution, while retaining the advantages of central data administration, as well as defect identification and
5 rectification, with greater flexibility.

~~One particularly advantageous feature is that~~ In another aspect, connections are set up via decentralized devices in the transport network. This
10 advantageously allows transport connections to be provided within a decentralized device, whose data streams therefore do not place any load on the central controller. A high level of redundancy is achieved and switching devices ~~according to the latest prior art~~ can
15 in each case ~~by~~ be used for the transport network, for example at the moment, ATM, Ethernet or IP switching devices.

~~In one refinement of the described method~~ another embodiment of the invention, one central device controls the decentralized switching devices in a particularly advantageous manner, ~~since this.~~ This
20 allows a number of decentralized devices to be connected to one another which, together, behave like a single switching device. In this way, connection-related service features, which are implemented centrally, can be provided for communications links via the transport network without needing any additional development work with regard to the transport network
25 ~~for this purpose.~~ There is likewise no need for any adaptations to the existing service features at the control end, in order to make them available throughout the network. It is ~~advantageously also possible~~ also advantageous to use methods such as this in distributed
30 switching devices throughout the network, which would otherwise be available ~~only~~ in a single local switching device, and not in a number of switching devices. Applications and interfaces for applications which
35

until now have been able to access only single systems can thus advantageously be used for the decentralized switching devices as well.

5 In ~~one variant of the described method~~ still another embodiment, terminals which can be accessed by means of a time slot multiplexing connection can particularly advantageously be connected via the transport network, with new suitable connection
10 information being generated in the controller from conventional time-slot-related connection information, in order to control the provision of a communications link via the transport network. This allows already existing methods to be used to control TDM switching
15 matrices, in order to set up connections based on this variant of the method.

 However, the method is also suitable, without any restrictions, for other dynamically set-up connections,
20 such as ATM connections or IP connections. For the controller, these connections appear to be similar to conventional TDM connections, and are also processed in the same way, specifically with conventional time-slot-related connection information also being generated for
25 this purpose, which is then in turn converted to new connection information, matched to the transport network. This also allows terminals which are not time-slot-related (not TDM-based) to be connected, such as IP or ATM terminals, ~~that is to say~~ e.g. IP telephones,
30 computers and ATM terminals.

 Already existing methods for controlling TDM connections can be used in this way in order to set up other connections.

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 This advantageously reduces the technical implementation effort ~~for this variant~~ and makes it easier for existing methods to migrate to new methods,

since all that is necessary is for ~~this~~ the control information to be matched to the requirements of the transport network.

5 In ~~one development of the described method~~ yet another embodiment, transport network connections are produced in a particularly advantageous manner by using an asynchronous transfer mode, since ATM networks are technically proven and offer a basis for greater
10 transport capacities and more flexible distribution of them. Furthermore ATM networks are particularly suitable for the time-critical transmission of high data rates via decentralized switching devices, since they can guarantee the quality features (quality of
15 service) required for voice and moving pictures.

 In ~~one development of the described method~~ still another embodiment, service features are provided in a particularly advantageous manner via the central
20 control device, since this allows any desired transport network to be supplied to an existing service feature control network. Furthermore, this advantageously allows already existing methods to be used to provide service features, and there is no need for independent
25 service feature control adaptation for each transport network. In this way, the transport network can be replaced without any major control reactions.

~~An arrangement for providing~~ In another embodiment of the invention, there is a system including, for
30 example, a communications link which has a separate control network, in particular for transmitting signaling information, and a separate transport network, ~~is particularly advantageous,~~ in which the
35 transport network is controlled by the control network via suitable means. The separation of the control network and transport network relates to the information routes through the network, ~~that is to say~~

e.g. to the logical topology of the networks. Physically, it is possible to use different networks or the same network for transmission. In this way, a minimal configuration is specified to solve the problem of specifying a communications arrangement which can be expanded in a flexible manner for any desired data transmission rates. They can also advantageously be adapted on a subscriber-specific basis.

The In one aspect, the transport network advantageously has a decentralized device for connection of a communications terminal, and a decentralized switching device, which is provided in the area of the decentralized device, in order to provide a communications device in the transport network. This makes it possible to supply large areas with communications links via a single private branch exchange, with the capability to keep the wiring complexity at a minimal level, since ~~only~~ the control network ~~need be~~ is routed to a control center, while the most suitable topology, even in the context of already laid or public networks, can be chosen for connecting the decentralized switching devices through the transport network.

~~One refinement of the described arrangement advantageously has~~ In one aspect of the system, there is a central control device in the control network, since this makes it possible for the subscriber administration and connection control, as well as the data storage, maintenance and protection associated with them, problem identification and rectification, and supply of new software issue standards to be carried out centrally.

In ~~one development~~ another aspect of the ~~described arrangement~~ system, the central control device is advantageously operatively connected to a

device for providing service features, ~~which.~~ This may also be an integral component of the control device since this allows central provision of connection-related service features and other service features with minimal installation and implementation effort. In addition to service features, ~~this~~ the device for providing service features can also provide further applications and/or an interface to applications which go beyond communications service features. External servers, for example for call center solutions, CTI (Computer Telephony Integration) can thus advantageously be connected in a centralized manner via standardized interfaces.

According to one ~~development of the described arrangement~~ aspect, a private branch exchange can ~~particularly~~ advantageously be set up, which combines at least two decentralized switching devices with a central control device since this provides a distributed private branch exchange in the form of a minimal configuration, which can be expanded in a modular manner as required.

~~One development of the described minimal configuration particularly advantageously has~~ In another aspect of the configuration, there is a device for providing connection-related service features and other service features, since this means that there is no need for the respective decentralized provision and implementation of the service features in the transport network for this private branch exchange.

It is ~~particularly~~ advantageous to have an emergency control device in the region of at least one decentralized device, which allows emergency operation between communications terminals which are connected to this decentralized device, if the central control device fails or the control network is interrupted.

This achieves a very high level of availability with a single system, corresponding to the availability of networked systems.

5 **BRIEF DESCRIPTION OF THE DRAWINGS**

Exemplary embodiments of the invention will be explained in more detail in the following text with reference to figures.

- 10 Figure 1 shows a conventional communications arrangement.
- Figure 2 shows an example of a new communications arrangement in the invention.
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- Figure 1 shows an example of a known private branch exchange 150 having two peripheral devices P1 and P2 to which a respective communications terminal KE1 or KE2 is connected, operating on a digital or
- 25 analog basis. These peripheral devices P1 and P2 are accommodated in the same physical area as the central device ZE1. For example, they are located in the same room or in the same cabinet with it. The terminals fill defined time slots in PCM data streams (Pulse Code
- 30 Modulation) with communication data. The digital or analog communications terminals KE1 and KE2 are connected to respective subscriber line modules SLMO1 and SLMO2 which add to or take from the PCM data stream digital data which is intended for the respective
- 35 terminals or originates from the respective terminals, via time slots which are defined by signaling. These PCM data streams are designated 100 and 200, respectively, in Figure 1. Furthermore, signaling

connections are shown, which are represented by 110 and 210, respectively. It should be noted that this is only a logical representation, and is not a physical representation. However, in reality, the transport data and the signaling data are transmitted in the same connecting cable.

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As ~~can clearly be seen here~~ illustrated, both the information to be transported and the signaling information are supplied to a central device ZE1 in this arrangement. In this case, messages 2 are collected and distributed by a message device DCL, and are interchanged between the central device ZE1 and peripheral devices P1, P2. The call processing CP controls the setting up and clearing of connections and ~~for this purpose uses, inter alia~~ for example, equipment-specific interface functions DH which, for example, are in the form of program modules. Setting commands 1 for the switching matrix MTS are produced in this way. These setting commands essentially indicate which input of the switching matrix ~~must~~ should be connected to which output in order to produce a communications link. The control function and connection function are thus carried out by a single physically integrated functional unit in the communications network.

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One alternative to extension of the area covered by an individual device 150 would be to network a number of devices 150, although this would result in
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20 Problems likewise occur in such devices with the modular expansion capability, not only in the number of connections but also in the amount of data which can be transmitted. By way of example, the switching matrix
25 MTS may be provided ~~only~~ as one entity. This means that, in the extreme, a new switching matrix with, for example, 4096 connections must be purchased and installed for one additional connection. The transmission rate in such systems is limited, for
30 example, by the capability to transmit ~~only~~ a maximum of 64 KBits or some other administratively defined or technically restricted amount of data, in each time slot, as is specified by the ISDN Standard. This type of configuration also makes it impossible to use
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Figure 2 shows an example of a new arrangement

for setting up communications links. By way of example, this arrangement shows the layout of a private branch exchange 250.

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10 This layout of a switching system has the advantage that already existing networks, such as public or private networks, can be used for the transport network. In this case, the control network just needs to be routed to the central device ZE2.

15 The digital or analog communications terminals KE1 and KE2 are illustrated here as being connected to respective subscriber line modules SLM01 and SLM02. However, without any restrictions to the invention, it is also feasible to integrate terminals in an arrangement 250 such as this which can be connected directly to the transport network 700, bypassing, or without, SLM0. It is thus also possible to connect ATM terminals or else IP-based (Internet Protocol) terminals.

25 As ~~can also be seen~~ illustrated, the decentralized devices DZ1 and DZ2 have respective decentralized switching devices CS1 and CS2 which may, for example, be in the form of ATM access devices. The illustration likewise shows that the switching matrix MTS0 is no longer used for connection tasks. ~~The~~
30 Rather, the transport network carries out the connection tasks, ~~instead of this.~~

35 In this arrangement, at least one control information item is in each case provided for setting up the communications link ~~just~~ for the respective decentralized switching devices CS1 and CS2 via the

control lines 410 and 310 for this purpose, with this control information item being derived from time-slot-related control information. Furthermore, the figure shows that PCM data is converted on a respective data
5 path 300 or 400 to cell data in accordance with the Standard of the transport network 700, such as ATM cell data. In this case, it should be noted that the use of an ATM network as the transport network serves ~~only~~ as an exemplary embodiment in this case. Ethernets, other
10 IP connections or even TDM connections can likewise be used for this purpose. The choice is dependent on the intended application and covers the entire range of available networks, both in the narrowband field and in the broadband field.

15

Since there are no communications links to the central device ZE2 in Figure 2, there is also no need in this ~~variant~~ embodiment to incur call charges for any connections of DZ1 and DZ2 to the central device
20 ZE2 via public lines, for example tie lines, as would have been the case for communication from DZ1 to DZ2 until now with a remote peripheral device 150 from Figure 1. Call processing which is independent of the transport network but which is restricted essentially
25 to basic call functionality is preferably carried out in the decentralized switching devices CS1 and CS2. Service features are ~~in this case~~ provided by the central controller ZE2. Connections between the various decentralized devices are controlled by the central
30 device ZE2 via signaling. The advantages of this arrangement are that it has both a narrowband and broadband capability. Furthermore, the transport network can be set up for both public networks and private networks, or else for a ~~mixture~~ combination of
35 both. In addition, it is possible to allocate to the central device ZE2 decentralized devices at a physically unrestricted distance away, so that even very large devices can be provided by such a private

branch exchange, which are in turn used to supply communications links for large areas. By retaining a central control device, it is possible to continue to use already existing software with minimal changes. If
5 one were to distribute the control process, or else the switching matrix, then new methods would need to be developed for control and a mechanism would have to be provided to ensure consistency between distributed
10 databases. A further advantage of such a device 250 over a networked system composed of devices 150 is that the distributed system is a single system, for which reason it is likewise possible to provide service features which are implemented ~~only~~ within the system. There is thus no need to convert individual service
15 features to provide them with the capability for operation on a network.

By way of example ~~and in simplified form~~, Figure 3 shows a message sequence in a conventional
20 communication system for setting up a connection between two peripheral devices to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. The time sequence of the messages, and control messages, is from top to bottom.
25 First ~~of all~~, the subscriber A goes off hook and generates the signaling information OFF HOOK. The desired communication partner is then dialed by entering dialing information, which is passed on from an equipment-specific interface module DH to the call
30 processing CP for the subscriber A.

The dialing assessment WABE of the dialing information leads to a message SEIZURE being passed to the call processing CP for the subscriber B. An
35 equipment-specific interface module DH, which has the responsibility there, assigns to the connection an explicit time slot, for example, ZS1 on a defined PCM data path, for example PD1, and generates the control

message TSL_ASSIGN to the subscriber line module SLM01. This control message tells the subscriber line module SLM01 the explicit time slot ZS1 and the defined PCM data path PD1 which is intended to be used for that
5 connection. The explicit time slot ZS1 in the PCM data path PD1 applies to the connection element between the subscriber line module SLM01 and the MTS. A second explicit time slot ZS2 in a second explicitly defined PCM data path PD2 applies to the connection element
10 between the MTS and the subscriber line module SLM02. The information ZS2 and PD2 is in turn signaled to the subscriber line module SLM02 in a control message TSL_ASSIGN. Generally, TDM based private branch exchanges use a TDM switching matrix MTS for physical connection
15 of individual subscribers. A setting command PATH_CONNECT1 is produced for this switching matrix and results in the time slot ZS1 being connected from the PCM data path PD1 to the time slot ZS2 for the PCM data path PD2. The two connection elements are thus
20 connected to form a continuous path between SLM01 and SLM02.

In this case, in conjunction with the embodiment of the method, it is irrelevant whether the CP and DH
25 are components of the control software, or whether they are in the form of individual modules or are integrated.

~~In simplified form and by~~ By way of example,
30 Figure 4 shows a message sequence between two decentralized devices, to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. In this case, an ATM network is used, by way of example, as the transport network. The
35 time sequence of the messages or signaling messages, is from top to bottom. A functional unit STMA converts the time slot for the PCM data stream to a cell stream of ATM cells. In Figure 2 a device such as this is

integrated in each of the decentralized switching devices CS1 and CS2, and for this reason is not shown separately.

5 The sequence differs from the sequence illustrated in Figure 3 ~~only~~ from the point where the setting command PATH_CONNECT1 is produced for the TDM switching matrix. Instead of a setting command PATH__CONNECT1, a control message PATH__CONN2 is
10 generated, which is sent to the decentralized switching devices. The decentralized switching devices then set up a connection on the transport network. When using an ATM transport network, by way of example, an ATMSVC is set up (ATM Switched Virtual Connection) by means of
15 ATM signaling methods.

The control message PATH__CONN2 ~~must for this purpose include~~ includes the time slot and data path information ZS and PD, which can be obtained, for
20 example, directly from the setting message PATH CONNECT1. Furthermore, the central control device ~~need specify only~~ specifies the transport-network-dependent address of that decentralized switching device for which the connection is intended to be set up. This
25 means that the data which ~~must be~~ is provided as information via the transport network for the central control is restricted to the transport-network-dependent addresses of the respective decentralized switching devices. The central control device once
30 again determines the necessary addresses from the time slot and data path information ZS and PD. Allocation tables in a central database DB control the mapping of the time slot/data path to the decentralized switching device.

35

The control message PATH__CONN2 may also include other information, and the control message PATH_CONNECT may also be generated in a number of more specific

forms. If it is intended to set up connections with different bandwidths, the control message PATH_CONN2 may also ~~contain~~ include information about the desired bandwidth. Alternatively, the bandwidth information can
 5 also be interchanged directly between the subscriber line module and the switching device.

When the decentralized switching devices have set up a connection in the transport network 700 after
 10 receiving the message, PATH_CONN2, the user data is then transmitted via this transport network 700. The allocation of a user data stream on the data path 300/400 between the subscriber line module and the decentralized device DZ to a connection between DZ1 and
 15 DZ2 is produced by mapping time slot details ZS and PD to form a connection identifier for the connection. This means that, despite the possibly complicated sequences for setting up a connection via the transport network from the central controller ZE2, preferably
 20 only these addresses need to be passed on to the call processing for the transport network in order to set up a connection via this transport network. The transport-network-specific call processing handles the rest.

25 According to this message sequence, the PATH_CONNECT command is thus replaced by transport-network-specific call processing. In order to allow TDM-based subscribers to be connected by decentralized switching devices independently of the transport
 30 network, it is necessary to convert time slots to transport units. This is done in a conversion unit, such as STMA, of which each decentralized device has at least one, which is preferably looped into the path of the user data. An ATM-PCM gateway or an IP-PCM gateway
 35 can be provided for this purpose.

The TDM-based subscriber line modules communicate with the conversion unit via, for example, connections

on a backplane motherboard in the respective decentralized device. A bus ~~with~~ which connects all the assemblies to one another can be provided for this purpose on ~~this~~ the printed circuit board. The setting
 5 commands for looping in the conversion unit are for this purpose preferably produced autonomously from the PATH__CONN2 message by the decentralized switching device.

10 However, the method is not restricted to dial connections that are set up dynamically, but can likewise control an ATMPVC (ATMPVC Permanent virtual connection). The information related to the address
 15 the use of fixed connections. Other forms of data transmission may also still be used, such as IP connections.

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Description

Communications system

5 The invention relates to a method and an arrangement for setting up and clearing communications links, in particular for the purposes of a private branch exchange and the terminals connected to it.

10 The increase in the amount of traffic resulting from the rising number of communications subscribers, as well as more stringent requirements for the amount of data to be transmitted, mean that switching devices, in particular at private branch exchanges, are subject
15 to ever more stringent requirements with regard to the amount of data to be transmitted per communications link, and with regard to the number of communications terminals which can be connected to one another. Present-day devices are based, for example, on the TDM
20 method (Time Division Multiplexing) in which communication data relating to different connections is transmitted in respectively defined time slots. Connection between different communications partners is produced by means of a switching matrix, which
25 allocates incoming time slots on a incoming connection to outgoing time slots on an outgoing connection, on the basis of control information. Switching matrices such as these are generally of a fixed size and can produce only a defined number of connections, which
30 often makes it harder to adapt switching systems to meet the requirements. Devices such as these have a further problem in that the time slots can hold a limited amount of data. For example, a switching matrix can produce 4096 connections, while a maximum of 64
35 KBits of data can be transmitted within one time slot. An increasing number of subscribers can thus only ever be coped with in groups of 4096 connections. However, utilization of these different extension levels demands

additional development effort to match the switching device to the greater number of subscribers. It is likewise impossible without problems to increase the amount of communication on each connection in a flexible manner, and this can best be done by setting up two or more communications links, that is to say in the form of a 64 kbit fit. In practice, this type of bandwidth duplication has, however, not been implemented for ISDN (Integrated Services Digital Network) transmission, and scarcely any terminals are available for this purpose.

The object on which the invention is based is to specify a method and an arrangement for providing a communications link, which allow a high level of flexibility with regard to matching to the number of communications links to be provided, matching to the amount of communication per connection, and to their physical extent. For the method, this object is achieved according to the features of patent claim 1, and for the arrangement it is achieved according to the features of patent claim 9. Developments of the invention can be found in the dependent claims.

Control and connection functions are carried out in a particularly advantageous manner by means of functional units which are physically separated from one another, since this allows distributed switching systems with the advantageous characteristics of central systems to be set up without any major development effort.

According to the described method, the control function is advantageously for this purpose provided in a control network, and the connection function is offered via a transport network, advantageously with the assistance of a connection device which may reside on a transport network of any desired type that is available and is suitable depending on the type of

application.

This means that an increased amount of communication can be dealt with by an appropriately designed transport network with an adequate transmission capacity, while the control, for example of a control network, need not be expanded, and can remain in its already existing form. Furthermore, the method ensures that decentralized communications arrangements which are distributed over a physically large area can be operated in which, in a particularly advantageous manner, only the control information to a central control device need be handled, while the communications links are provided via a separate transport network of suitable topology.

According to one development of the described method, when using a central control device, existing databases and control methods for a central switching device can still advantageously be used in order to control decentralized switching devices in the transport network in order to provide a communications link. This ensures smooth migration of existing solutions to the described new solution, while retaining the advantages of central data administration, as well as defect identification and rectification, with greater flexibility.

One particularly advantageous feature is that connections are set up via decentralized devices in the transport network. This advantageously allows transport connections to be provided within a decentralized device, whose data streams therefore do not place any load on the central controller. A high level of redundancy is achieved and switching devices according to the latest prior art can in each case be used for the transport network, for example at the moment, ATM, Ethernet or IP switching devices.

In one refinement of the described method, one central device controls the decentralized switching devices in a particularly advantageous manner, since
5 this allows a number of decentralized devices to be connected to one another which, together, behave like a single switching device. In this way, connection-related service features, which are implemented centrally, can be provided for communications links via
10 the transport network without needing any additional development work with regard to the transport network for this purpose. There is likewise no need for any adaptations to the existing service features at the control end, in order to make them available throughout
15 the network. It is advantageously also possible to use methods such as this in distributed switching devices throughout the network, which would otherwise be available only in a single local switching device, and not in a number of switching devices. Applications and
20 interfaces for applications which until now have been able to access only single systems can thus advantageously be used for the decentralized switching devices as well.

25 In one variant of the described method, terminals which can be accessed by means of a time slot multiplexing connection can particularly advantageously be connected via the transport network, with new suitable connection information being generated in the
30 controller from conventional time-slot-related connection information, in order to control the provision of a communications link via the transport network. This allows already existing methods to be used to control TDM switching matrices, in order to set
35 up connections based on this variant of the method.

However, the method is also suitable, without any restrictions, for other dynamically set-up connections,

such as ATM connections or IP connections. For the controller, these connections appear to be similar to conventional TDM connections, and are also processed in the same way, specifically with conventional time-slot-related connection information also being generated for this purpose, which is then in turn converted to new connection information, matched to the transport network. This also allows terminals which are not time-slot-related (not TDM-based) to be connected, such as IP or ATM terminals, that is to say IP telephones, computers and ATM terminals.

Already existing methods for controlling TDM connections can be used in this way in order to set up other connections.

This advantageously reduces the technical implementation effort for this variant and makes it easier for existing methods to migrate to new methods, since all that is necessary is for this control information to be matched to the requirements of the transport network.

In one development of the described method, transport network connections are produced in a particularly advantageous manner by using an asynchronous transfer mode, since ATM networks are technically proven and offer a basis for greater transport capacities and more flexible distribution of them. Furthermore ATM networks are particularly suitable for the time-critical transmission of high data rates via decentralized switching devices, since they can guarantee the quality features (quality of service) required for voice and moving pictures.

35

In one development of the described method, service features are provided in a particularly advantageous manner via the central control device,

since this allows any desired transport network to be supplied to an existing service feature control network. Furthermore, this advantageously allows already existing methods to be used to provide service features, and there is no need for independent service feature control adaptation for each transport network. In this way, the transport network can be replaced without any major control reactions.

An arrangement for providing a communications link which has a separate control network, in particular for transmitting signaling information, and a separate transport network, is particularly advantageous, in which the transport network is controlled by the control network via suitable means. The separation of the control network and transport network relates to the information routes through the network, that is to say to the logical topology of the networks. Physically, it is possible to use different networks or the same network for transmission. In this way, a minimal configuration is specified to solve the problem of specifying a communications arrangement which can be expanded in a flexible manner for any desired data transmission rates. They can also advantageously be adapted on a subscriber-specific basis.

The transport network advantageously has a decentralized device for connection of a communications terminal, and a decentralized switching device, which is provided in the area of the decentralized device, in order to provide a communications device in the transport network. This makes it possible to supply large areas with communications links via a single private branch exchange, with the capability to keep the wiring complexity at a minimal level, since only the control network need be routed to a control center, while the most suitable topology, even in the context of already laid or public networks, can be chosen for connecting the decentralized switching devices through

the transport network.

One refinement of the described arrangement advantageously has a central control device in the control network, since this makes it possible for the subscriber administration and connection control, as well as the data storage, maintenance and protection associated with them, problem identification and rectification, and supply of new software issue standards to be carried out centrally.

In one development of the described arrangement, the central control device is advantageously operatively connected to a device for providing service features, which may also be an integral component of the control device since this allows central provision of connection-related service features and other service features with minimal installation and implementation effort. In addition to service features, this device for providing service features can also provide further applications and/or an interface to applications which go beyond communications service features. External servers, for example for call center solutions, CTI (Computer Telephony Integration) can thus advantageously be connected in a centralized manner via standardized interfaces.

According to one development of the described arrangement, a private branch exchange can particularly advantageously be set up, which combines at least two decentralized switching devices with a central control device since this provides a distributed private branch exchange in the form of a minimal configuration, which can be expanded in a modular manner as required.

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One development of the described minimal configuration particularly advantageously has a device for providing connection-related service features and

other service features, since this means that there is no need for the respective decentralized provision and implementation of the service features in the transport network for this private branch exchange.

5

It is particularly advantageous to have an emergency control device in the region of at least one decentralized device, which allows emergency operation between communications terminals which are connected to this decentralized device, if the central control device fails or the control network is interrupted. This achieves a very high level of availability with a single system, corresponding to the availability of networked systems.

15

Exemplary embodiments of the invention will be explained in more detail in the following text with reference to figures.

Figure 1 shows a conventional communications arrangement,

Figure 2 shows an example of a new communications arrangement,

Figure 3 shows an example of a message sequence in a known switching system.

25

Figure 4 shows an example of a message sequence using time-slot-related connection information for the transport network.

Figure 1 shows an example of a known private branch exchange 150 having two peripheral devices P1 and P2 to which a respective communications terminal KE1 or KE2 is connected, operating on a digital or analog basis. These peripheral devices P1 and P2 are accommodated in the same physical area as the central device ZE1. For example, they are located in the same room or in the same cabinet with it. The terminals fill defined time slots in PCM data streams (Pulse Code

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Modulation) with communication data. The digital or analog communications terminals KE1 and KE2 are connected to respective subscriber line modules SLMO1 and SLMO2 which add to or take from the PCM data stream digital data which is intended for the respective terminals or originates from the respective terminals, via time slots which are defined by signaling. These PCM data streams are designated 100 and 200, respectively, in Figure 1. Furthermore, signaling connections are shown, which are represented by 110 and 210, respectively. It should be noted that this is only a logical representation, and is not a physical representation. However, in reality, the transport data and the signaling data are transmitted in the same connecting cable.

Furthermore, peripheral devices P1 and P2 as well as line trunk units LTUC1 and LTUC2 are shown here, which control the data traffic to the subscriber line modules of respective decentralized devices. The peripheral device P1 is supplied with signaling data via the line 110 and the peripheral device P2 is supplied with signaling data via the signaling line 210.

As can clearly be seen here, both the information to be transported and the signaling information are supplied to a central device ZE1 in this arrangement. In this case, messages 2 are collected and distributed by a message device DCL, and are interchanged between the central device ZE1 and peripheral devices P1, P2. The call processing CP controls the setting up and clearing of connections and for this purpose uses, inter alia, equipment-specific interface functions DH which, for example, are in the form of program modules. Setting commands 1 for the switching matrix MTS are produced in this way. These setting commands essentially indicate which input of the switching

matrix must be connected to which output in order to
produce a communications link. The control function and
connection function are thus carried out by a single
physically integrated functional unit in the
5 communications network.

Problems occur with configurations such as these,
since all the data to be transported must be supplied
to the central device ZE1. This is true even when, for
10 example, two communications terminals which are
connected to the same peripheral device P1 wish to
communicate with one another. The wiring complexity
that needs to be accepted in such devices increases
with the distance between the terminals and the central
15 device ZE1, so that this type of arrangement restricts
extension of the area covered by a private branch
exchange, or makes the installation considerably more
expensive when covering relatively large areas.

20 One alternative to extension of the area covered
by an individual device 150 would be to network a
number of devices 150, although this would result in
the advantages of a single system being lost. When
networking a number of such devices 150, one
25 exacerbating factor is that additional trunk assemblies
with additional connecting cables must be provided and
installed in each case.

Problems likewise occur in such devices with the
30 modular expansion capability, not only in the number of
connections but also in the amount of data which can be
transmitted. By way of example, the switching matrix
MTS may be provided only as one entity. This means
that, in the extreme, a new switching matrix with, for
35 example, 4096 connections must be purchased and
installed for one --additional connection. The
transmission rate in such systems is limited, for
example, by the capability to transmit only a maximum

of 64 KBits or some other administratively defined or technically restricted amount of data, in each time slot, as is specified by the ISDN Standard. This type of configuration also makes it impossible to use
 5 different data rates on each individual communications link.

Figure 2 shows an example of a new arrangement for setting up communications links. By way of example,
 10 this arrangement shows the layout of a private branch exchange 250.

Components of the device which are the same as those in Figure 1 have the same reference symbols in
 15 Figure 2. Referring now to Figure 2, it is immediately evident that there is a separate transport network 700 and a separate control network 310/410 in this case. This layout of a switching system has the advantage that already existing networks, such as public or
 20 private networks, can be used for the transport network. In this case, the control network just needs to be routed to the central device ZE2.

The digital or analog communications terminals
 25 KE1 and KE2 are illustrated here as being connected to respective subscriber line modules SLM01 and SLM02. However, without any restrictions to the invention, it is also feasible to integrate terminals in an arrangement 250 such as this which can be connected directly
 30 to the transport network 700, bypassing, or without, SLM0. It is thus also possible to connect ATM terminals or else IP-based (Internet Protocol) terminals.

As can also be seen, the decentralized devices
 35 DZ1 and DZ2 have respective decentralized switching devices CS1 and CS2 which may, for example, be in the form of ATM access devices. The illustration likewise shows that the switching matrix MTS0 is no longer used

for connection tasks. The transport network carries out the connection tasks, instead of this.

5 In this arrangement, at least one control
information item is in each case provided for setting
up the communications link just for the respective
decentralized switching devices CS1 and CS2 via the
control lines 410 and 310 for this purpose, with this
10 control information item being derived from time-slot-
related control information. Furthermore, the figure
shows that PCM data is converted on a respective data
path 300 or 400 to cell data in accordance with the
Standard of the transport network 700, such as ATM cell
15 data. In this case, it should be noted that the use of
an ATM network as the transport network serves only as
an exemplary embodiment in this case. Ethernets, other
IP connections or even TDM connections can likewise be
used for this purpose. The choice is dependent on the
intended application and covers the entire range of
20 available networks, both in the narrowband field and in
the broadband field.

Since there are no communications links to the
central device ZE2 in Figure 2, there is also no need
25 in this variant to incur call charges for any
connections of DZ1 and DZ2 to the central device ZE2
via public lines, for example tie lines, as would have
been the case for communication from DZ1 to DZ2 until
now with a remote peripheral device 150 from Figure 1.
30 Call processing which is independent of the transport
network but which is restricted essentially to basic
call functionality is preferably carried out in the
decentralized switching devices CS1 and CS2. Service
features are in this case provided by the central
35 controller ZE2. Connections between the various
decentralized devices are controlled by the central
device ZE2 via signaling. The advantages of this
arrangement are that it has both a narrowband and

broadband capability. Furthermore, the transport network can be set up for both public networks and private networks, or else for a mixture of both. In addition, it is possible to allocate to the central device ZE2 decentralized devices at a physically unrestricted distance away, so that even very large devices can be provided by such a private branch exchange, which are in turn used to supply communications links for large areas. By retaining a central control device, it is possible to continue to use already existing software with minimal changes. If one were to distribute the control process, or else the switching matrix, then new methods would need to be developed for control and a mechanism would have to be provided to ensure consistency between distributed databases. A further advantage of such a device 250 over a networked system composed of devices 150 is that the distributed system is a single system, for which reason it is likewise possible to provide service features which are implemented only within the system. There is thus no need to convert individual service features to provide them with the capability for operation on a network.

By way of example and in simplified form, Figure 3 shows a message sequence in a conventional communication system for setting up a connection between two peripheral devices to which the terminal of a subscriber A, TLNA and the terminal of a subscriber B, TLNB are connected. The time sequence of the messages, and control messages, is from top to bottom. First of all, the subscriber A goes off hook and generates the signaling information OFF HOOK. The desired communication partner is then dialed by entering dialing information, which is passed on from an equipment-specific interface module DH to the call processing CP for the subscriber A.

The dialing assessment WABE of the dialing information leads to a message SEIZURE being passed to the call processing CP for the subscriber B. An equipment-specific interface module DH, which has the responsibility there, assigns to the connection an explicit time slot, for example, ZS1 on a defined PCM data path, for example PD1, and generates the control message TSL_ASSIGN to the subscriber line module SLMO1. This control message tells the subscriber line module SLMO1 the explicit time slot ZS1 and the defined PCM data path PD1 which is intended to be used for that connection. The explicit time slot ZS1 in the PCM data path PD1 applies to the connection element between the subscriber line module SLMO1 and the MTS. A second explicit time slot ZS2 in a second explicitly defined PCM data path PD2 applies to the connection element between the MTS and the subscriber line module SLMO2. The information ZS2 and PD2 is in turn signaled to the subscriber line module SLMO2 in a control message TSL ASSIGN. Generally, TDM based private branch exchanges use a TDM switching matrix MTS for physical connection of individual subscribers. A setting command PATH_CONNECT1 is produced for this switching matrix and results in the time slot ZS1 being connected from the PCM data path PD1 to the time slot ZS2 for the PCM data path PD2. The two connection elements are thus connected to form a continuous path between SLMO1 and SLMO2.

In this case, in conjunction with the embodiment of the method, it is irrelevant whether the CP and DH are components of the control software, or whether they are in the form of individual modules or are integrated.

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In simplified form and by way of example, Figure 4 shows a message sequence between two decentralized devices, to which the terminal of a subscriber A, TLNA

and the terminal of a subscriber B, TLNB are connected. In this case, an ATM network is used, by way of example, as the transport network. The time sequence of the messages or signaling messages, is from top to bottom. A functional unit STMA converts the time slot for the PCM data stream to a cell stream of ATM cells. In Figure 2 a device such as this is integrated in each of the decentralized switching devices CS1 and CS2, and for this reason is not shown separately.

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The sequence differs from the sequence illustrated in Figure 3 only from the point where the setting command PATH_CONNECT1 is produced for the TDM switching matrix. Instead of a setting command PATH__CONNECT1, a control message PATH__CONN2 is generated, which is sent to the decentralized switching devices. The decentralized switching devices then set up a connection on the transport network. When using an ATM transport network, by way of example, an ATMSVC is set up (ATM Switched Virtual Connection) by means of ATM signaling methods.

20

The control message PATH__CONN2 must for this purpose include the time slot and data path information ZS and PD, which can be obtained, for example, directly from the setting message PATH__CONNECT1. Furthermore, the central control device need specify only the transport-network-dependent address of that decentralized switching device for which the connection is intended to be set up. This means that the data which must be provided as information via the transport network for the central control is restricted to the transport-network-dependent addresses of the respective decentralized switching devices. The central control device once again determines the necessary addresses from the time slot and data path information ZS and PD. Allocation tables in a central database DB control the mapping of the time slot/data path to the decentralized switching device.

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The control message PATH_CONN2 may also include other information, and the control message PATH_CONNECT may also be generated in a number of more specific forms. If it is intended to set up connections with different bandwidths, the control message PATH_CONN2 may also contain information about the desired bandwidth. Alternatively, the bandwidth information can also be interchanged directly between the subscriber line module and the switching device.

When the decentralized switching devices have set up a connection in the transport network 700 after receiving the message, PATH_CONN2, the user data is then transmitted via this transport network 700. The allocation of a user data stream on the data path 300/400 between the subscriber line module and the decentralized device DZ to a connection between DZ1 and DZ2 is produced by mapping time slot details ZS and PD to form a connection identifier for the connection. This means that, despite the possibly complicated sequences for setting up a connection via the transport network from the central controller ZE2, only these addresses need to be passed on to the call processing for the transport network in order to set up a connection via this transport network. The transport-network-specific call processing handles the rest.

According to this message sequence, the PATH_CONNECT command is thus replaced by transport-network-specific call processing. In order to allow TDM-based subscribers to be connected by decentralized switching devices independently of the transport network, it is necessary to convert time slots to transport units. This is done in a conversion unit, such as STMA, of which each decentralized device has at least one, which is preferably looped into the path of the user data. An ATM-PCM gateway or an IP-PCM gateway

can be provided for this purpose.

The TDM-based subscriber line modules communicate with the conversion unit via, for example, connections on a backplane motherboard in the respective decentralized device. A bus with connects all the assemblies to one another can be provided for this purpose on this printed circuit board. The setting commands for looping in the conversion unit are for this purpose preferably produced autonomously from the PATH_CONN2 message by the decentralized switching device.

However, the method is not restricted to dial connections that are set up dynamically, but can likewise control an ATMPVC (ATMPVC Permanent virtual connection). The information related to the address must then be interchanged with information controlling the use of fixed connections. Other forms of data transmission may also still be used, such as IP connections.

Patent Claims

1. A method for setting up and/or clearing a communications link having the following features:
 - a) a connection function (CS1, CS2, 700) for setting up and/or clearing a communications link for transporting communication data is carried out by at least one functional unit in a communications network;
 - b) a control function for controlling the connection function is carried out by a second functional unit (ZE2, 310, 410) in the communications network; and
 - c) the first and the second functional units are physically separated from one another.
2. The method as claimed in claim 1, having the following features:
 - a) signaling is carried out in order to control the setting up and/or clearing of a communications link;
 - b) the connection is set up and/or cleared via a transport network (700);
 - c) signaling is carried out via a control network (310, 410).
3. The method as claimed in claim 2, in which the signaling is controlled by a central device (ZE2).
4. The method as claimed in one of the preceding claims, in which the communications link in the transport network is set up via at least one decentralized device (CS1, CS2).
5. The method as claimed in claims 3 and 4, in which the central device (ZE2) controls a decentralized switching device (CS1, CS2).
6. The method as claimed in one of the preceding claims, in which a communications link (300, 400) is

set up and/or cleared to a communications terminal (KE1), and in which the connection via the transport network (700) is set up by producing at least one time slot control information item in the central device (ZE2), which information item is used for setting up connections in the transport network (700).

7. The method as claimed in claim 6, in which the time slot control information is linked to transport-network-specific information and is transmitted to a decentralized device (CS1, CS2).

8. The method as claimed in one of the preceding claims, in which an asynchronous transmission method is used for transmission via the communications link (700).

9. The method as claimed in one of claims 2 to 7, in which at least one connection-related service feature and/or a service feature or application, related to the central device is provided by the central device (ZE).

10. An arrangement for setting up and/or clearing a communications link,
a) which has a transport network (700) for providing a communications link (300, 400),
b) which has a control network (310, 410) for controlling the setting up and/or clearing of the communications link (700, 300, 400),
c) and which has means for controlling the setting-up and/or clearing of connections in the transport network (300, 400, 700) by means of a control network (310, 410), with these means being arranged physically separately from the transport network.

11. The arrangement as claimed in claim 9, in which the transport network has at least one decentralized device ((SLM01, SLM02) for connection of a

communications terminal (KE1, KE2), and has a switching device (CS1, CS2) in the region of the decentralized device in order to provide a communications link in the transport network.

12. The arrangement as claimed in claim 9, in which the control network (310, 410) has a central device (ZE2) for control.

13. The arrangement as claimed in claim 11, which has central means for providing at least one connection-related service feature and/or a service feature or application relating to a central device, with these means being operatively connected to the central device (ZE2).

14. The arrangement as claimed in claim 10 or 11, which is in the form of a private branch exchange and has at least two decentralized devices (DZ1, DZ2) for connection of communications terminals (KE1, KE2).

15. The arrangement as claimed in claim 12 and claim 13.

16. The arrangement as claimed in one of claims 9 to 14, which, in the region of the decentralized device (DZ1, DZ2), has a control device (CS1, CS2) for providing a communications link in the region of this decentralized device, if the central control device (ZE2) is not available.

Abstract

Communications system

A method and an arrangement are specified for setting up and clearing communications links via a private branch exchange. The transport network for transporting the communication data is preferably in the form of an ATM network or IP network, and is controlled by a separate control network, separated from it. The advantage is that the two networks are independent of one another, and that broadband communications requirements can be satisfied easily by a modular expansion capability. The central control configuration allows already existing central databases relating to subscribers to be used, and likewise allows connection-related service feature control systems still to be used.

Figure 2

1/4

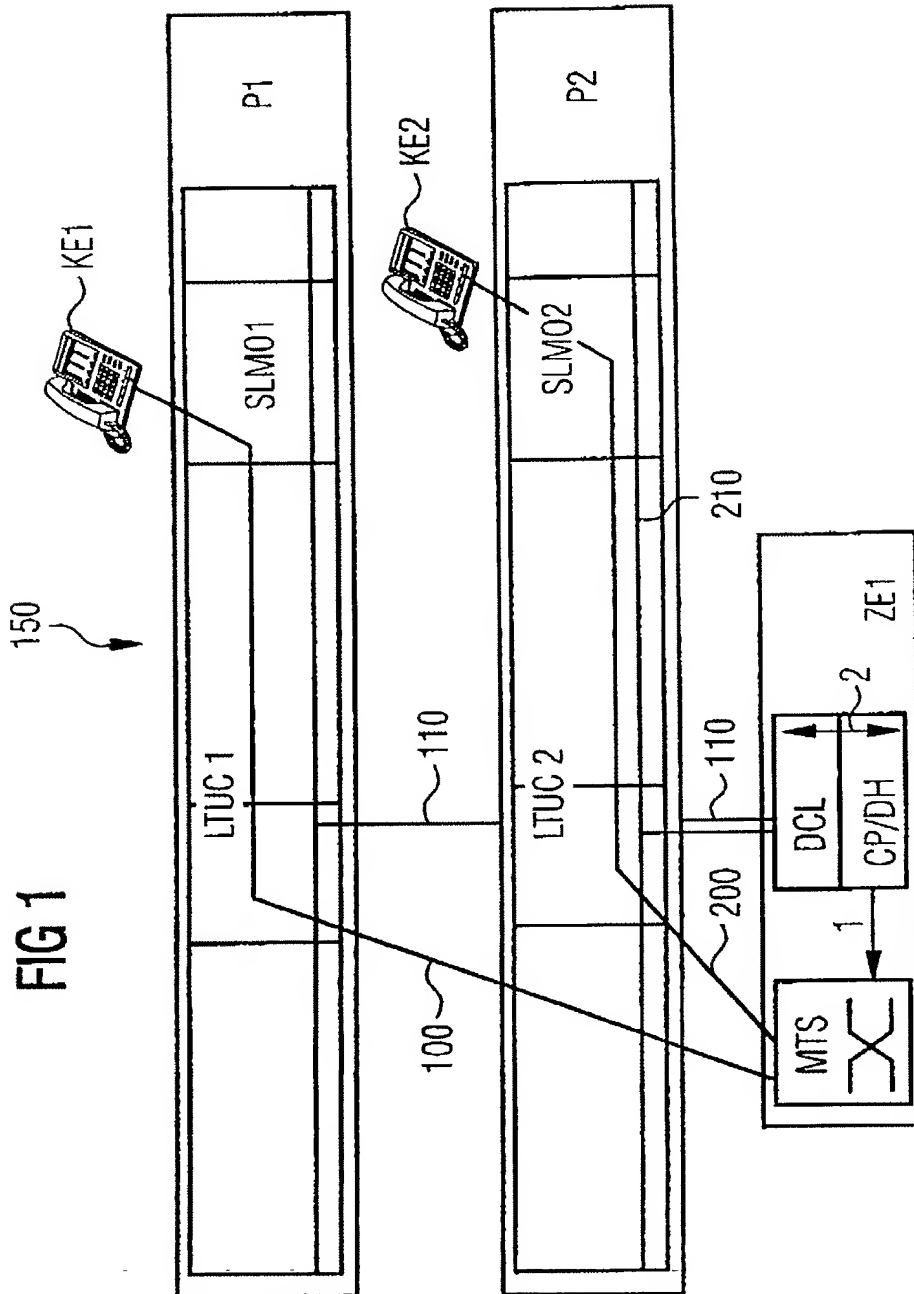
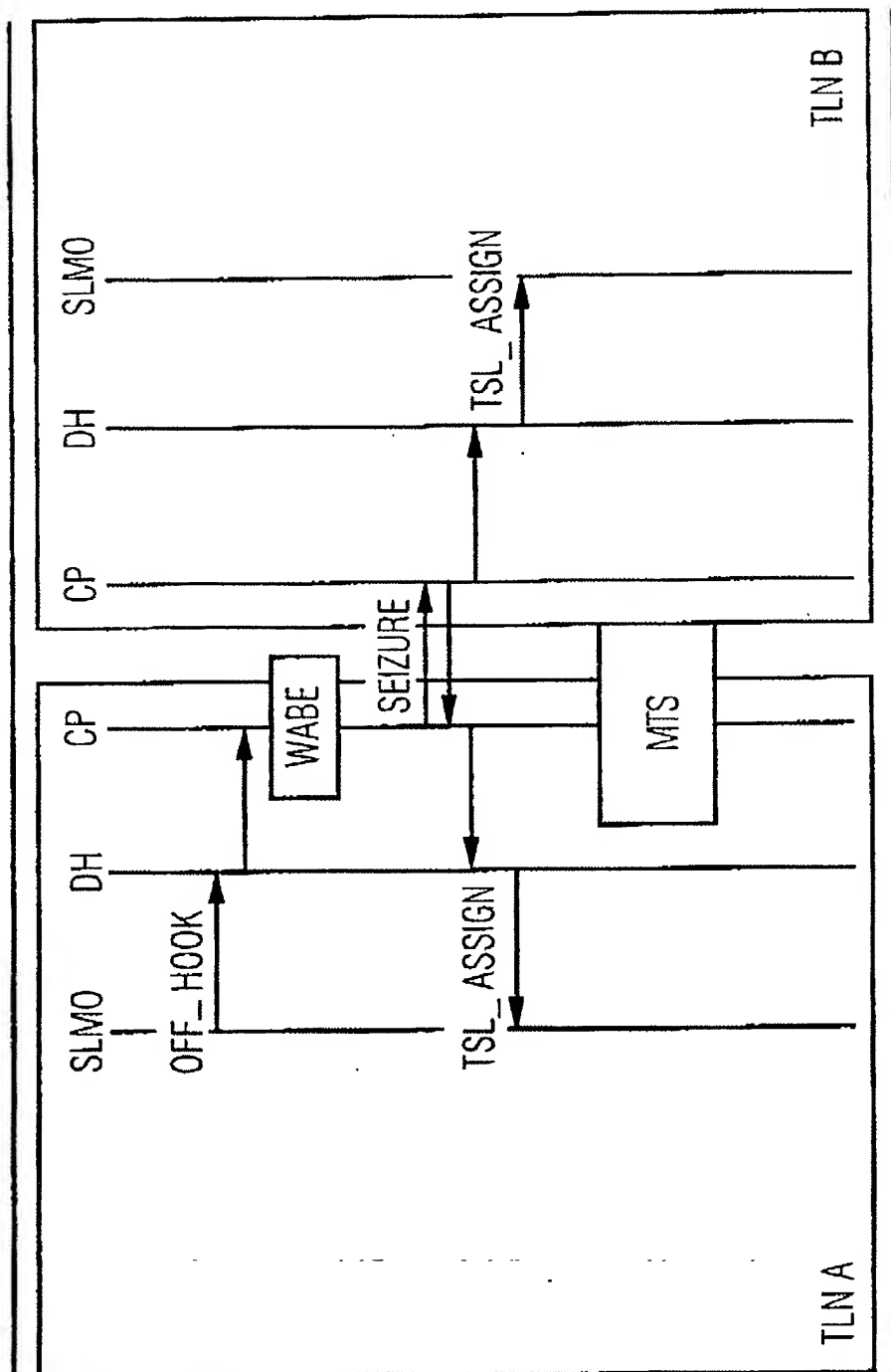
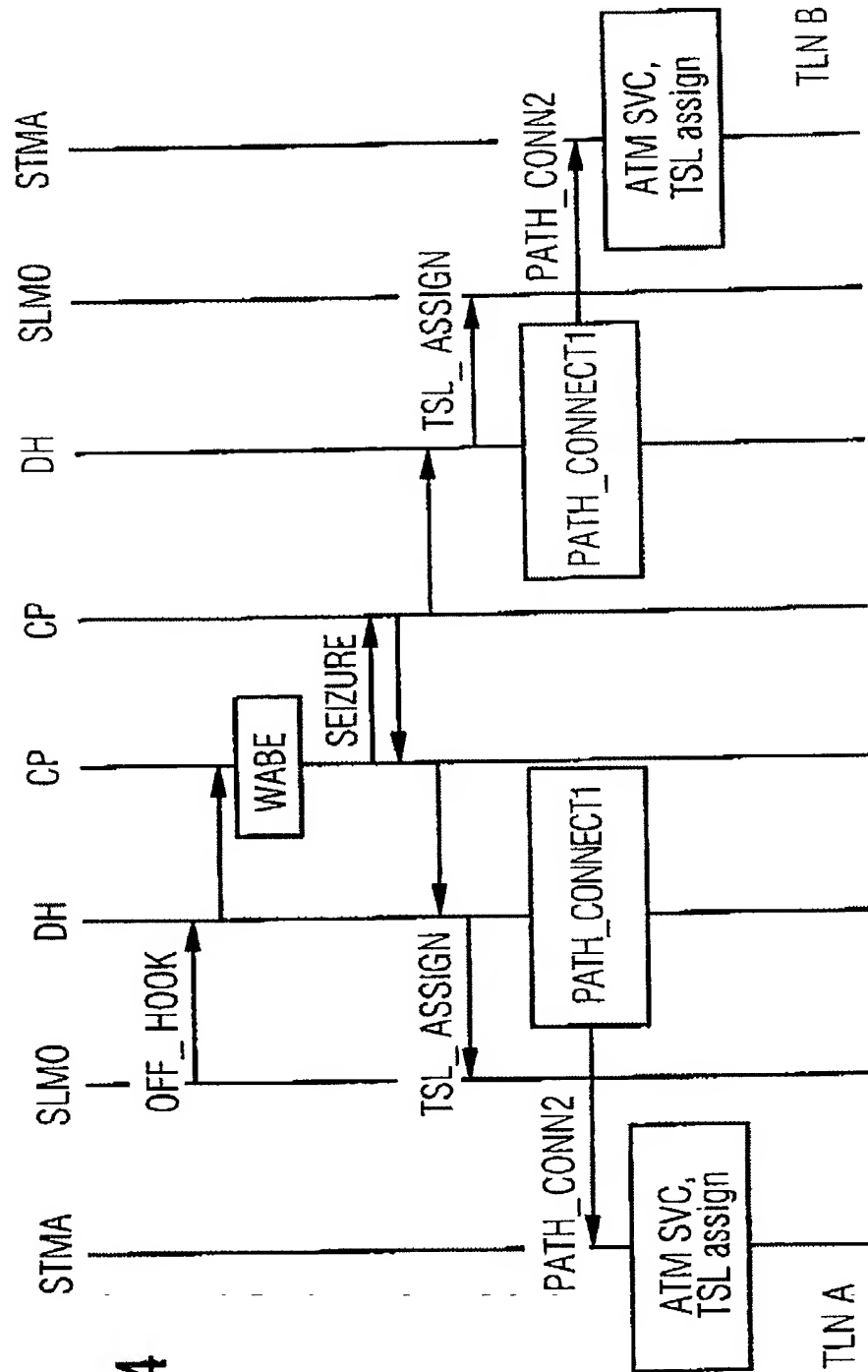


FIG 3





IG 4

Declaration and Power of Attorney For Patent Application

Erklärung Für Patentanmeldungen Mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt.

As a below named inventor, I hereby declare that

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Kommunikationssystem

Communications system

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)

(check one)

☐ hier beigefügt ist.

☐ is attached hereto.

☒ am 23.08.2000 als

☒ was filed on 23.08.2000 as

PCT internationale Anmeldung

PCT international application

PCT Anwendungsnummer PCT/DE00/02870

PCT Application No. PCT/DE00/02870

eingereicht wurde und am

and was amended on (if applicable)

abgeändert wurde (falls tatsächlich abgeändert)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1 56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1 56(a)

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed

German Language Declaration

Prior foreign applications
Priorität beansprucht

Priority Claimed

19941345.2 DE
(Number) (Country)
(Nummer) (Land)

31.08.1999
(Day Month Year Filed)
(Tag Monat Jahr eingereicht)

<input checked="" type="checkbox"/>	<input type="checkbox"/>
Yes	No
Ja	Nein

(Number)	(Country)
(Nummer)	(Land)

(Day Month Year Filed)
(Tag Monat Jahr eingereicht)

☐ Yes
☐ No
Ja Nein

(Number)	(Country)
(Nummer)	(Land)

(Day Month Year Filed)
(Tag Monat Jahr eingereicht)

☐ Yes
☐ No
Ja Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

PCT/DE00/02870 ✓
(Application Serial No.)
(Anmeldeseriennummer)

23.08.2000 ✓
(Filing Date D, M, Y)
(Anmeldedatum T, M, J)

anhangig
(Status)
(patentiert, anhangig,
aufgegeben)

pending
(Status)
(patented, pending,
abandoned)

(Application Serial No)
(Anmeldeseriennummer)

(Filing Date D,M,Y)
(Anmeldedatum T, M, J)

(Status)
(patientiert, anhängig,
aufgeben)

(Status)
(patented, pending,
abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden koennen.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon

German Language Declaration

VERTRETUNGSVOLLMACHT. Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt. (Name und Registrationsnummer anführen)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Customer No. 25227

And I hereby appoint

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(Name und Telefonnummer)

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Unterschrift des Erfinders	Datum	Second Inventor's signature	Date
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81671 Muenchen		81671 Muenchen	

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben)--

(Supply similar information and signature for third and subsequent joint inventors)

4-BD

5-00

6-00

(Supply similar information and signature for third and subsequent joint inventors).

7-00	Voller Name des siebten Miterfinders <u>Andreas Steffan</u>	Full name of seventh joint inventor Andreas Steffan
	Unterschrift des Erfinders <u>[Signature]</u> Datum Date	Inventor's signature Date
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	Staatsangehörigkeit DE ✓	Citizenship DE
	Postanschrift Sentilostr. 43	Post Office Address Sentilostr. 43
	81477 Muenchen	81477 Muenchen
8-00	Voller Name des achten Miterfinders (falls zutreffend): <u>Josef Wahler</u>	Full name of eighth joint inventor, if any: Josef Wahler
	Unterschrift des Erfinders <u>[Signature]</u> Datum Date	Inventor's signature Date
	Wohnsitz <u>Taufkirchen, DEUTSCHLAND DEX</u>	Residence Taufkirchen, GERMANY
	Staatsangehörigkeit DE ✓	Citizenship DE
	Postanschrift Dorfstr.33/K	Post Office Address Dorfstr.33/K
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9-00	Voller Name des neunten Miterfinders (falls zutreffend): <u>Rainer Windecker</u>	Full name of ninth joint inventor, if any: Rainer Windecker
	Unterschrift des Erfinders <u>[Signature]</u> Datum Date	Inventor's signature Date
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	Staatsangehörigkeit DE ✓	Citizenship DE
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	81739 Muenchen	81739 Muenchen
10-00	Voller Name des zehnten Miterfinders (falls zutreffend): <u>Steffi Winkler</u>	Full name of tenth joint inventor, if any: Steffi Winkler
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